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The Psychological Record, 2007, 57, 517–531

DEICTIC RELATIONAL COMPLEXITY AND THE DEVELOPMENT OF DECEPTION

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An empirical investigation of age-related development of the ability to deceive was conducted from the perspective of Relational Frame Theory, which, unlike the traditional approach, Theory of Mind, has been used to analyze deception in terms of the complexity of the relational responding involved. A derived relational responding–based protocol was used to compare the deception-taking skills of five different age groups. Results indicated that performances on the tasks improved as a function of age, supporting the current concept of deception as a learned relationally complex behavioral pattern. The findings are discussed in terms of their implications for the mainstream developmental literature on deception.

Deception is defined as the intentional deceit or misleading of a second party to influence that party's behavior (Heyes, 1988). Arguably the most well researched approach to deception thus far is by researchers working under the rubric of Theory of Mind (ToM; e.g., Baron-Cohen, Tager-Flusberg, & Cohen, 2000). From this perspective, children's ability to understand and predict social behavior becomes increasingly sophisticated as they develop increasingly complex representations of mental informational states in themselves and others. According to ToM, deception requires a relatively advanced theory or representation of mind, because it necessitates the ability to mentally represent false beliefs, a relatively advanced ToM ability, as well as being able to construct and impart such beliefs to others (e.g., see Yirmiya et al., 1996).

More recently, a number of theories have begun to approach ToM-relevant skills, including deception in terms of relational complexity (e.g.,

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Andrews, Halford, Bunch, Bowden, & Jones, 2003; McHugh, Barnes-Holmes, & Barnes-Holmes, 2004). One such approach is Relational Frame Theory (RFT; Hayes, Barnes-Holmes & Roche, 2001), which conceptualizes language and higher cognition as derived or generalized relational responding. The purpose of the present article is to report an RFT-based investigation of the age-related development of deception. To sketch the background to this research, first, a brief description of ToM, including the approach to deception, will be provided. Next, an introduction to RFT will be given, including a relational frame account of the skill of deception. Finally a description of the present study will be laid out.

ToM

According to Howlin, Baron-Cohen, and Hadwin (1999), a person's knowledge of informational states in the self and others develops across five levels from simple visual perspective-taking to understanding true and false beliefs. Levels 1–3 consist of simple visual perspective-taking, complex visual perspective-taking, and applying information based on the principle of seeing leads to knowing, respectively. Levels 4 and 5 of this model consist of the development of understanding true and false beliefs, respectively. In this view, the skills of perspective-taking are believed to be essential prerequisites for the development of an understanding of true and false beliefs.

In the ToM literature, deception involves understanding other minds because it requires a person to make someone else believe that something is true when it is in fact false (i.e., see Baron-Cohen, Tager-Flusberg, & Cohen, 2000). According to ToM, children must reach Level 5, the ability to represent false beliefs, before they can begin to show deception, which involves the deliberate construction and communication of a false belief to another (see Yirmiya et al., 1996). Deception, from a ToM perspective, has been demonstrated in normally developing children around the age of 6 years (Marvin, Greenberg, & Mossler, 1976).

A range of procedures have been employed by ToM researchers to assess deception skills in children, including traditional hide-and-seek games and the more complex Unexpected Transfer Task (Chandler, Fritz, & Hala, 1989; Wimmer, & Perner, 1983). The Unexpected Transfer Task involves employing dolls and props to enact a sequence of events. For instance, children are asked whether a boy, whose mother changed the location of a bar of chocolate in his absence, would know where the chocolate was when returning to the scene. Wimmer and Perner found that children aged 4 years and older responded correctly by indicating that the boy would not know where the chocolate was and thus would look for the chocolate in the place in which he had left it. In contrast, the view holds that younger children would not complete the task successfully because they could not reconcile the conflict between reality and their own knowledge of the truth (i.e., that the chocolate is now in the cupboard) and the boy's false mental state (i.e., the belief that the chocolate is where he put it because he did not see it being moved; Wellman, Cross, & Watson, 2001).

The false-belief scenario has been extended as a means of assessing behavior on tasks of deception. The scenario, as described above, unfolds as follows: The boy's brother is introduced. Children are instructed that the boy's brother also wants the chocolate and so he asks the boy where it is. If the boy (who still wrongly believes that the chocolate is in Cupboard X) wishes to deceive his brother and avoid him getting the chocolate, then he must deceive his brother by telling him the chocolate is in Cupboard X, although he believes the chocolate to be in Cupboard Y. Of course, the deception in this case is based on the boy's false belief (that the chocolate is in Cupboard X), and thus it is likely that his attempts to deceive his brother will unintentionally lead him to identify the correct cupboard (Y) in which the chocolate is placed. This complex scenario, therefore, incorporates an understanding of both false belief and deception and is complicated further by the participants' own true belief concerning the location of the chocolate.

One of the primary reasons for the interest in deception has arisen from reliable findings suggesting that children with autism present deficits both in understanding and orchestrating deception (Baron-Cohen, 1992; Baron-Cohen & Hammer, 1997; Baron-Cohen et al., 2000). An example of one test is the "penny hiding game," in which the aim is not to reveal the hand you have hidden a penny in. Young children with autism often make errors in this game, which suggests they do not understand how to deceive very well (Baron-Cohen, 1992).

RFT

Until relatively recently, however, behavior analysts have paid little or no attention to the development of complex cognitive abilities such as deception. With the recent advent of the functional analytic behavioral approach known as RFT (Hayes, Barnes-Holmes, & Roche, 2001), however, this situation has begun to change. RFT researchers conceptualize deception, like many other complex cognitive abilities, as generalized operant behavior referred to as derived or arbitrarily applicable relational responding. Similar empirical predictions have been proposed under RFT (Hayes, Barnes-Holmes, & Roche).

According to RFT, deception can be understood in terms of the relation between deictic terms used to describe one's perspective on events in the environment and the physical location within the environment (McHugh, Barnes-Holmes, & Barnes-Holmes, 2004; McHugh, Barnes-Holmes, Barnes-Holmes, & Stewart, 2006). The deictic relations that are most important in this regard are I-YOU, HERE-THERE, and NOW-THEN. What is unique about deictic relations is that unlike other relations, they do not appear to have formal or nonarbitrary counterparts. (For example, "same as" relations can be based on physical [or perceptual] rather than arbitrary similarity.) Instead, it is the relationship between the individual and the environment that serves as the constant variable on which deictic frames are based. Deictic relations are believed to emerge in part through a history of responding to questions such as "What am I doing here?"

and "What were you doing then?" Although the form of these questions is often identical across contexts, the physical environment is always different. What remain consistent are the relational properties of I versus YOU, HERE versus THERE, and NOW versus THEN. These relational properties are said to be abstracted through learning to talk about one's perspective in relation to the perspective of others (Barnes-Holmes, Stewart, Dymond, & Roche, 2000; Dymond & Barnes, 1997; Hayes, 1984). For example, I is always from this perspective HERE and NOW but not from the perspective of another person THERE and THEN.

From this perspective, deictic relations are critical in understanding deception as illustrated in the following example. Imagine that I wish to deceive you about the location of a book. I may tell you that "I put the book on the bookshelf," whereas in fact I put the book in my briefcase. As a result of this false version of events, you will likely look for the book on the bookshelf and not in my briefcase. The RFT interpretation of these events is as follows (see Figure 1): (1) To deceive you, I must first be able to take the perspective of YOU to determine where YOU will believe the book to be, from the information I provide. (2) In this case, the if-then relation controls a transfer of information (where I believe the book to be) in accordance with an entailed deictic relation, (3) as well as a transfer of information (where you will look for the book) in accordance with a relation of distinction (relation c: between the actual location of the book and where I say the book is). In this way, approaching deception as something that

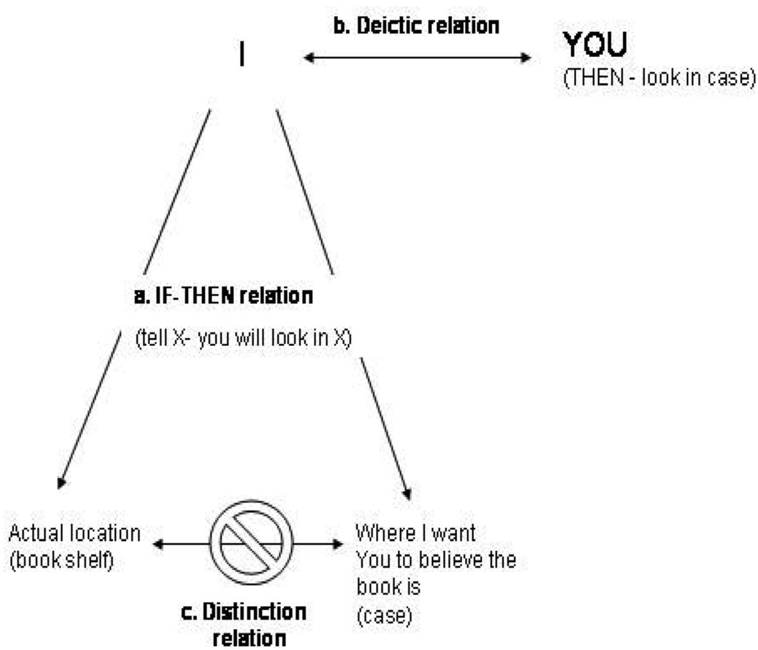

Figure 1. Diagrammatic representation of the relations involved in deceiving another.

involves deictic relational complexity may allow for a unique analysis of the underlying processes involved in deceiving another. This analysis allows the predictions of relational complexity to be extended to the domain of deception by means of harmonization with the procedures of RFT.

The aim of the present study was to investigate deception task performance of five different age groups in the context of tasks involving varying levels of relational complexity. The five age groups consisted of 3- to 5-, 6- to 8-, 9- to 11-, 12- to 16-, and 20- to 30–year-olds). Two different forms of relational complexity were systematically manipulated. The first was deictic complexity, which was manipulated at three levels (i.e., first order, second order, and control). The second was nondeictic complexity, which was manipulated at two levels (negative and positive). It was predicted that outcomes would be a function of age, with younger participants showing a greater distinction in performance on the nondeictic tasks depending on the level of relational complexity involved.

An important distinction in the current tasks can be made between tasks that involve increased relational complexity but no deictic relational complexity (NDRC) and tasks that involve increased deictic relational complexity (DRC). The former was manipulated with the introduction of negation. Negated relations are inherently more relationally complex. For example, to know that John is not Mary you need to know that John is John and Mary is Mary prior to negating the relation. DRC tasks varied on the basis of the introduction of the prefix "I know you know," which involves the same relation taken from different deictic perspectives. It is predicted that outcomes will be a function of age, with younger participants showing a greater distinction in performance on the nondeictic tasks, depending on the level of relational complexity involved. These tasks involve manipulating negation a repertoire that should be emerging in the young children's repertoires. However, very young children will predictably not show as much indication of differential deictic relational responding, as deictic responding involves taking the perspective of another. This more complex form of relational responding is predicted to produce a greater within-group distinction in the older participants.

Method

Participants and Setting

The current study involved 40 participants, 8 from each of five age ranges as follows: 3–5 years (early childhood), 6–8 years (middle childhood), 9–11 years (late childhood), 12–15 years (adolescence), and 18–30 years (adulthood). All adult participants were recruited through faculty board advertisements from within the Department of Psychology at the National University of Ireland, Maynooth. The children and adolescents who participated were volunteers recruited from several schools within the Dublin area. Only those for whom no identified learning difficulty was present were selected. The consent of parents and teachers was obtained prior to the participation of each child or adolescent.

The study was conducted in a small, quiet room that contained a desk, a chair, and a laptop personal computer. The laptop had a 550-MHz processor, a 14-inch (35.6-cm) color monitor, and a standard computer mouse for input. All stimulus presentation and recording of responses were controlled with the computer, which was programmed in Microsoft Visual Basic 6.0.

Procedure

The same general procedure was employed with all five groups of participants. However, a number of minor modifications were made to simplify the presentation of the experimental tasks for the early and middle childhood groups. The details concerning the general procedure, therefore, for each of these two groups will be described separately below.

Late childhood, adolescent, and adult groups. Participants from the three oldest groups were exposed to all 60 tasks randomly presented in one experimental session, during which the experimenter remained outside the experimental room. Before the commencement of the experimental tasks, participants were exposed to a series of practice sessions in which they were familiarized with the basic computer interactions that were necessary to conduct the experimental tasks. For the three oldest groups of participants, this simply involved using the computer mouse to drag and drop several practice sets containing three pictures, in which one picture was dropped onto the source picture on screen. Each participant continued with the practice sets until she or he indicated readiness to begin the experimental tasks.

Prior to the first experimental task, each participant had the following instructions read aloud to them:

> Each computer screen presents three pictures and a question. The question will appear at the very top of the screen. There will also be one picture below the question and then another two pictures at the bottom of the screen. You will also hear the question in my voice presented aloud on the headphones. Your job is to look at the screen and to try to answer the question regarding the pictures. You answer the questions by simply placing the picture at the top of the screen on top of one of the pictures below. All you have to do is use the mouse to drag the picture from the top and drop it onto the one on the bottom which you think is correct. The computer will then present the next task immediately. The computer will let you know when the experiment is over.

After the instructions had been read out, the sheet on which they appeared was placed on the table beside the participant, where it remained for the rest of the experimental session. At that point, each participant was asked whether he or she had any questions, and where appropriate, these queries were addressed immediately. After addressing all queries, the experimenter directed the participant's attention to the screen and then left the room.

After the last test trial had been completed, the following message appeared on the screen: "Thank you for your participation. Please report to the experimenter." Once the experimenter reentered the room, the participant was thanked and debriefed.

Early and middle childhood groups. Three key modifications with regard to the running of the experiment were necessary for the youngest group of participants, although the types of tasks and their presentations were identical. First, all "drag and drop" interactions with the program were conducted by the experimenter. In other words, each child was simply required to orient toward one of the pictures on-screen, point to the picture, and name the picture onto which the other picture would be dropped. The response was then conducted by the experimenter. Second, five additional practice tasks were conducted with these participants to ensure that they were fully aware of what they were being asked to do. Third, these participants were exposed to five experimental sessions of 12 tasks each (rather than one session of 60 tasks).

Protocol

The deception protocol consisted of one block of 60 questions comprising six types of tasks and five stimulus sets (two of each task type per set; see Table 1). Tasks varied along two dimensions of complexity: (1) deictic relational complexity (i.e., first- and second-order) and (2) nondeictic relational complexity (i.e., presence or absence of logical NOT; see Table 2). The six tasks, therefore, were denoted as follows: first-order positive tasks, first-order negative tasks, second-order positive tasks, second-order negative tasks, control positive tasks, and control negative tasks.

Table 1

The Five Stimulus Sets Presented During the Experiment

Stimulus Set	Object to Be Hidden	Locations for Hiding Objects
Set 1	Teddy bear	Toy box and refrigerator
Set 2	Loaf of bread	Bread bin and cookie jar
Set 3	Pencils	Pencil case and Smarties box
Set 4	Cookies	Teapot and cookie jar
Set 5	Shirt	Car and wardrobe

Note. Each stimulus set was constructed specifically for the deception protocol and contained three items that were related in a particular way. For example, Set 1 consisted of a teddy bear, a toy box, and a refrigerator. These items were selected because one might expect to find a teddy in a toy box but not in a fridge. In this way, the hypothetical locations of the items could be manipulated for the purposes of deception.

First-order positive tasks involved a low level of deictic relational complexity and did not include a statement of logical NOT. Consider an I task type (in which a picture of a teddy bear was presented on the screen above pictures of a toy box and a refrigerator), as given in Table 2. This task is referred to as first-order because it involved the simple attribution of one person's belief by another (e.g., "if I want you to find it, where do

Table 2

Task Types Involving Stimulus Set 1

First-order positive task
If I have a teddy and I want you to find it, where should I put the teddy?
If you have a teddy and you want me to find it, where should you put the teddy?
First-order negative task
If I have a teddy and I don't want you to find it, where should I hide the teddy?
If you have a teddy and you don't want me to find it, where should you hide the teddy?
Second-order positive task
If I have a teddy and if I know that you know I'm trying to hide it from you, where should I hide the teddy?
If you have a teddy and if you know that I know you're trying to hide it from me, where should you hide the teddy?
Second-order negative task
If I have a teddy and if I know that you don't know I'm trying to hide it from you, where should I hide the teddy?
If you have a teddy and if you know that I don't know you're trying to hide it from me, where should you hide the teddy?
Control-positive task
You and I are playing a game. If I have a teddy and I want you to find it, where should I put the teddy?
You and I are playing a game. If you have a teddy and you want me to find it, where should you put the teddy?
Control-negative task
You and I are playing a game. If I have a teddy and I don't want you to find it, where should I hide the teddy?
You and I are playing a game. If you have a teddy and you don't want me to find it, where should you hide the teddy?

you think I should hide it"), and it is described as positive because it did not involve logical NOT (i.e., "I wanted you to find it"). It was predicted that all participants would produce high levels of accuracy on first-order positive tasks.

First-order negative tasks involved the same level of complexity with regard to deictic complexity as first-order positive tasks; however, on the second dimension of complexity (i.e., positive or negative), they involved the additional frame of logical NOT, which in this case permitted a degree of deception in the task (see Table 2). A correct response to these tasks involves the participant reasoning as follows: "I (Experimenter) should hide the teddy in the refrigerator rather than in the toy box, because YOU will be unlikely to look in the refrigerator since one would not normally look for a teddy in a refrigerator." It was predicted that first-order negative tasks would encourage more errors, particularly in the younger groups of participants, than the first-order positive tasks because of the added complexity (logical NOT) involved in the former but not in the latter.

Second-order tasks involved more deictic complexity than first-order tasks. These tasks were also divided into positive and negative tasks.

Consider the following second-order positive task presented in Table 2. In this task, participants are required to engage in a relatively high level of deictic complexity to understand the deception. The correct response in this case involves the participant making the following deductions: "If YOU think I am trying to deceive YOU, then YOU will think that I will place the teddy in the refrigerator as a place in which one would not normally expect to find a teddy. However, if I, as the deceiver, know that YOU will think this, then I will place the teddy in the toy box rather than in the refrigerator." In this case, therefore, the correct response involves determining that I will hide the teddy in the toy box. Because second-order positive tasks involved a high level of deictic complexity, it was hypothesized that younger participants would produce more errors on them than on first-order positive tasks.

Second-order negative tasks were similar in form to second-order positive tasks, except that they included logical NOT (see Table 2). In these tasks, the level of deictic complexity remains high and the deception is made more complex by the inclusion of logical not. Responding correctly to these tasks involves the participant making the following deductions: "You have the teddy and you are trying to hide it from me. If I do not know this, I will think that the teddy is in the toy box (where one would naturally expect to find a teddy). If you know that I think this, then you will likely hide the teddy in the unexpected location, the refrigerator." Hence, responding correctly to this task would involve hiding the teddy in the refrigerator. Because second-order negative tasks involved both a high level of deictic complexity and logical NOT, it was predicted that younger participants would produce more errors than on second-order negative tasks.

Increasing the level of complexity between first-order and second-order tasks rendered the instructional statement presented during the task longer in the latter than in the former. In the case of the younger participants in particular, therefore, it would be difficult to determine whether weaker performances were a result of increased relational complexity or simply of a perceived increase in task complexity due to the length of instruction. Furthermore, it was also possible that the young participants would find it more difficult to attend to tasks containing longer instructional statements. To control for these two possible influences, two additional types of task were incorporated into the protocol, namely a control positive task and a control negative task. These tasks were identical in structure to the first-order positive and negative tasks, respectively, except that an additional phrase was added (i.e., "you and I are playing a game"), so that that the instructional statement was also the same length as that presented during a second-order task. This particular phrase was selected because it matched approximately the length of the additional phrase used in the second-order tasks ("if I know that you don't know") but did not alter the complexity of the task in any way. Both positive and negative control tasks also contained I and YOU task types (see Table 1). It was hypothesized that participants would respond to the control positive and control negative tasks in much the same way as they would respond on the first-order positive and first-order negative tasks, respectively, because the only differences between these tasks was the length of the instruction provided.

Results

The number of correct responses in each of the six task types was calculated for each of the five age categories, and these data are presented in Figure 2. It shows a developmental trend for accuracy across five of the six types of task (i.e., all except second-order positive tasks). Amalgamating numbers of correct responses in each age group showed that participants in the youngest age group (3–5 years) produced the least number of correct responses (*M*: 27.38), while participants in the oldest age group (18–30 years) produced the largest number of correct responses (*M*: 58.13).

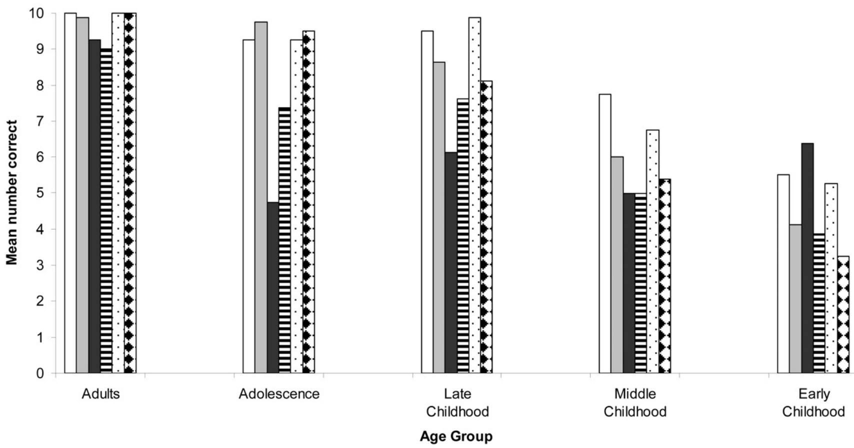

Figure 2. Mean number correct across the five age groups for the five trial types: first-order positive (white bars); first-order negative (gray bars); second-order positive (black bars); second-order negative (striped bars); control positive (dotted bars); and control negative (diamond bars).

To determine whether age affected task performance, a 2 × 3 × 5 mixed repeated measures ANOVA, with Valence (positive or negative) and Complexity (first order, second order, or control) as the within-subject variables and Age as the between-subject variable, was performed. The analysis revealed a significant main effect for Age, F (4, 35) = 17.45, $p < .0001$, and for Complexity, F (2, 70) = 17.09, $p < .0001$, but not for Valence. There was a significant interaction between Complexity and Age, F (2, 70) = 4.75, $p < .0001$, and between Complexity and Valence, F (2, 70) = 9.08, $p < .0001$, but no significant interaction between Valence and Age. Finally, there was also a three-way interaction between Age, Valence, and Complexity, F (8,70) = 2.24, $p < .05$.

Figure 2 indicates some common trends across age group for participants' performances on the various task types. All groups were more accurate on first-order than on second-order Complexity tasks. In addition, on the first-order tasks, greater accuracy was observed for positive than for negative Valence tasks, particularly among the three youngest groups of participants. Within the second-order tasks, greater accuracy on the positive tasks was recorded for both of the two youngest groups, while both of the two oldest groups appeared to produce more accurate performances on the second-order negative tasks. Similar accuracy scores emerged for all groups on the first-order positive and control positive tasks, as well as on the first-order negative and control negative tasks. These latter findings suggest that the apparent differences between first-order and second-order tasks were not merely a function of the length of the question presented within a task. If the latter was the case, then the control tasks would have differed from the first-order tasks in a manner similar to the differences recorded with the second-order tasks.

Age Comparison t *Tests*

The planned comparisons across the five age groups revealed that eight of the 10 comparisons were significant, particularly those involving comparisons of the early and middle childhood groups with the older participants. The statistical differences were as follows: early childhood versus middle childhood, t (14) = 2.15, p <.05; early childhood versus late childhood, t (14) = 6.12, p < .0001; early childhood versus adolescence, t (14) = 10.09, p < .0001; early childhood versus adulthood, t (14) = 21.30, p < .0001; middle childhood versus late childhood, t (14) = 3.32, p < .005; middle childhood versus adolescence, t (14) = 4.25, p < .005; middle childhood versus adulthood, t (14) = 7.362, p < .0001; and late childhood and adulthood, t (14) = 2.261, p < .005. Nonsignificant differences were recorded between late childhood and adolescence, t (14) = 0.00, p > .05, and between adolescence and adulthood, t (14) =3.77, p > .05. These findings support the developmental trend apparent in Figure 2 and suggest that the greatest differences in accuracy were recorded between those participants with the largest age differences, while smaller differences were recorded between those participants who were closer in age.

DRC and NDRC Comparisons

An important distinction in the current tasks might be made between tasks that involve increased relational complexity but NDRC and tasks that involve increased DRC. The former were manipulated by the introduction of negation. Comparisons of the five age groups and across NDRC and DRC tasks (Holm's sequential Bonferroni method being employed across all pair-wise comparisons to control for Type I errors) revealed that for early childhood, there was no significant difference between positive first order and positive second order, t (7) = –1.59, p > .05; positive first order and positive control, t (7) = .271, p > .05; negative first order and negative control, t (7) = .919, p > .0; positive first order and negative first order, t (7) = 1.21, p > .05; *or* positive second order and negative second order t (7) = 1.64, p > .05.

For the middle childhood group a significant effect emerged for positive first order versus positive second order, t (7) = 2.43, $p < .05$; positive first order versus positive control, t (7) = 2.37, $p < .0$; and positive first order versus negative first order, t (7) = 4.25, $p < .01$. There was no significant effect for negative first order versus negative control, t (7) = –.63, $p > .05$; or positive second order versus negative second order, t (7) = .00; $p > .05$

Analysis for the late childhood group revealed a significant effect for positive first order versus positive second order, t (7) = 3.07, $p < .05$; and no significant difference for positive first order versus positive control, t (7) = –1.43, $p > .05$; negative first order versus negative control, t (7) = –.882, $p > .05$; positive first order versus negative first order, t (7) = 1.41, $p > .05$; or positive second order versus negative second order, t (7) = –0.764, $p > .05$.

The analysis for the adolescence group revealed a significant effect for positive first order versus positive second order, t (7) = 3.72, $p <.05$; and no significant effect for positive first order versus positive control, t (7) = 0.00, $p > .05$; negative first order versus negative control, t (7) = –1.95, $p > .05$; positive first order versus negative control, t (7) = 1.58, $p > .05$; or positive second order versus negative second order t (7) = –1.54; $p > .05$. Finally, the analysis for the adult group indicated no significant difference at the .05 level between any of the task comparisons.

In summary, only at adolescence does performance on positive and negative relations correspond. Furthermore, while the two youngest age groups of children do not seem to show as much indication of differential deictic relational responding (thus no decrement between first and second order), all the way through to adolescence there is such an indication and such a decrement (controlling for mere complexity), and it is pronounced even in adolescence.

Discussion

The results of the current study yielded significant between-group differences with regard to age, with the two younger groups (i.e., 3- to 5-year-olds and 6- to 8-year-olds) producing significantly more correct responses than the older groups. Indeed, the findings on the deception protocol overall suggested that levels of accuracy increased as a function of age. Moreover, the level of relational complexity involved in the tasks was reflected with lower levels of accurate responding. All five groups of participants produced higher levels of accuracy on the two types of first-order tasks (involving less deictic relational complexity) than on the two types of second-order tasks (involving more deictic relational complexity). As predicted, this finding was particularly pronounced for the two youngest age groups of participants. The incorporation of control tasks indicated that it was the higher level of complexity involved in responding to these tasks and not the added word length per se that accounted for the differences in accurate responding between the first-order and the second-order tasks.

The current data are consistent with previous findings from the relational complexity literature, in that the greater the complexity involved in the tasks, the higher the error rate, particularly with the youngest group of participants (Andrews et al., 2003). This consistency was also observed in the greater accuracy scores for first-order tasks relative to second-order ones, in that the latter clearly involve a higher degree of deictic relational complexity. It is interesting that there were no significant differences in performance on tasks that involved logical NOT versus those that did not. Previous perspective-taking research by McHugh et al. (2004) demonstrated that manipulating deictic complexity (across the relations of I-YOU, HERE-THERE, and NOW-THEN) produced significantly different levels of responding. Specifically, the more deictic complexity involved in tasks was directly correlated with lower accuracy levels. However, in a subsequent study, targeting false belief, McHugh et al (2006) compared tasks with and without logical NOT rather than deictic complexity per se. No significant differences emerged for trial type, suggesting a functional overlap with the results of the present study in that accuracy on deception and false belief tasks did not vary as a function of logical NOT (whether the tasks were positive or negative).

The current work extends the findings of previous empirical analyses of perspective taking and false belief from an RFT perspective to the domain of deception in demonstrating a developmental profile (McHugh et al., 2004; McHugh et al., 2006). The similarities in the developmental trends for perspective taking, false belief, and deception suggest some overlap in the relational skills targeted in the relevant protocols and support the RFT view that repertoires of derived relational responding, especially responding in accordance with the deictic perspective-taking frames, lie at the core of these complex cognitive abilities (Barnes-Holmes et al., 2000; Barnes-Holmes, Barnes-Holmes, & Cullinan, 2001).

A possible criticism of the present study might be that responding to questions presented on the computer screen does not involve the same behavioral processes as purposeful deceiving or changing perspective over the course of social interactions with another person. This notion questions the construct validity of the current protocol. However, if one cannot respond in accordance with the basic relations involved in deception on the computer screen, then perhaps one is also unable to deceive someone in real life. In other words, if there *is* a difference between these two situations, it is likely that real-life scenarios are more complex. Specifically, to deceive someone requires you to understand true versus false and the effect of false understanding on someone's action. If you do not have this basic understanding, then you cannot deceive another.

RFT offers an analysis of perspective taking that explains this behavior as being based on a history of in principle empirically analyzable subject-environment interactions. Perspective taking, false belief, and deception are conceptualized by RFT as particular patterns of arbitrarily applicable relational responding or relational framing, which RFT sees as the core behavior involved in language. Multiple different relational response patterns are implicated in language development, including patterns of Same, Different, Opposite, More Than/Less Than, and so forth (Hayes et al., 2001).

According to RFT, arbitrarily applicable relational responding is established, in large part, by an appropriate history of exemplar training (Hayes & Hayes, 1989). RFT allows for the implementation and refinement of interventions in which these frames have not developed or are at a weak strength (for example, persons with diagnoses on the autistic spectrum; Baron-Cohen, 1992). With RFT, it would be predicted that poor performance on deictic relational tasks would be remediated through explicit exposure to multiple exemplars of training tasks employed across numerous stimulus sets. The procedures reported herein might facilitate the harmonization of tasks from the relational complexity literature with RFT and allow for the establishment of repertoires, where deficient, ab initio.

One advantage of the relational frame approach is that it affords the possibility to establish deictic relational repertoires where they are lacking. This possibility may be achieved by, for instance, exposing participants to a series of deception tasks across multiple exemplars and then exposing participants to a test phase that involves a novel set of stimuli. Explicit training of this kind across multiple exemplars may accelerate the natural learning cycle and permit investigation of the conditions necessary for a deception repertoire to become established. Future research should address this issue.

Researchers from the previous RFT studies on perspective taking and false belief noted the consistency between the RFT data and the results from more traditional theory of mind research. It is not surprising, therefore, that the findings of the current study are also consistent with the results of the mainstream literature on the development of deception. For example, Wimmer and Perner (1983) reported a sharp developmental increase in children's ability to deceive between the ages of four and six years, which is largely consistent with the present findings. This overlap with both previous RFT studies and existing mainstream findings suggests that there may be some utility in building conceptual bridges to the RFT view of deception and related skills as complex repertoires of derived relational responding.

In concert with previous studies, the current findings demonstrate that RFT may facilitate the analysis of psychological events that previously did not appear particularly amenable to a behavior analytic investigation. Furthermore, the current work suggests that deception may be usefully defined in terms of functionally distinct relational operants, and the systematic analysis of these operants might well inform a behavioral understanding of what it means to deceive another. This development, therefore, could also have important implications for the establishment of deception and complex perspective-taking skills in the context of programs of remediation for persons without these skills. The broad and diverse nature of the applicability of this work suggests that future research in this area is a worthwhile endeavor.

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